

No. 8. — *The Echinoderm Fauna of Bermuda*

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In 1888 appeared the first list of Bermudan echinoderms, that of Professor Angelo Heilprin of the Philadelphia Academy of Natural Sciences, who took a party of students to the islands in the summer of that year. Their collections contained 6 nominal kinds of holothurians (now believed to represent only 4 valid species), 2 sea-stars, 6 brittle-stars and 6 sea-urchins, a total of 20 species. The list was published in December, 1888, in the Proceedings of the Academy of Natural Sciences. In September, 1898, I published "Notes on the Echinoderms of Bermuda," based on collections made by Professor C. L. Bristol of New York University in the summer of 1897. This appeared in the Annals of the New York Academy of Sciences (11, pp. 407-413) and includes 28 species but at least 5 of the holothurians were of doubtful validity. Further collections by Professor Bristol's students in 1898 led to my publishing a revised list in July, 1899 (see Annals N. Y. Acad. Sci., 12, pp. 117-138), containing 29 species, but one of these is a synonym, one is only the young of another and a third is incorrectly identified. In April, 1899, I spent two weeks in Bermuda, and in June and July, another party from New York University was in the field. This field work led to my publishing a third paper entitled "Bermudan Echinoderms" (see Proc. Boston Soc. Nat. Hist., 29, pp. 339-344, May, 1901) which also includes 29 species and corrects errors in the earlier lists.

Meanwhile Professor A. E. Verrill had begun his series of papers on the Bermudas and their fauna, which added much to our knowledge of the echinoderms. His first contribution appeared in the Transactions of the Connecticut Academy of Arts and Sciences, 10, pp. 583-587, in the fall of 1900 (the signatures are dated both September and October, though the cover says September) and is called "Additions to the Echinoderms of the Bermudas", using my first list as the basis for the additions. These were chiefly brittle-stars, several of which were not taken by the Yale party, but rest on earlier and dubious records. The "*Synapta viridis*" listed is synonymous with *Synaptula hydriformis*. In October, 1901, in the same journal (11, pp. 35-37) a second contribution appeared, called "Additions to the Fauna of the Bermudas", which lists 5 species of echinoderms, taken by the Yale Expedition in the spring and early summer of 1901. Only one of these species is an addition to previous lists. In April 1907, further notes on the echinoderms of Bermuda with special reference to habits and

habitats appeared in volume XII of the Transactions. On pp. 100-102 are references to the various holothurians and echini which secure their nourishment by passing mud and sand through the alimentary canal. A sea-star and a brittle-star are also discussed in connection with their sandy habitat. On pp. 275-285, a list is given of the Echinoderms found on or about corals and the coral reefs, with notes as to their occurrence and habits. Altogether in these lists of 1907, Verrill reports a total of 36 species of Echinoderms in the Bermudan fauna.

In 1919, in a paper on the Distribution of the Littoral Echinoderms of the West Indies (Carnegie Inst., Publ. 281, pp. 49-74), I listed 42 species from Bermuda, but 2 or 3 of these are unquestionably mistakes. In 1922, my "Echinoderms from the Challenger Bank, Bermuda" (Proc. Amer. Acad., 57, pp. 353-361, pl. 1) appeared, listing 13 species, but only 8 of these are as yet known from Bermuda. In 1933, my "Handbook of the Littoral Echinoderms of Porto Rico and the other West Indian Islands" was published by the New York Academy of Sciences (Sci. Survey of Porto Rico, 16, pt. 1), with a list of 41 Bermudan species on p. 124. This however includes as an inexcusable error, a mythical species "*Ophiozona imbricata*"; presumably *Ophiozona impressa*, long ago listed from Bermuda but apparently by error, as it has not been taken in the past half century.

In April, 1939, I enjoyed a stay of 18 days at the Bermuda Biological Station, during which I did shore collecting at ten different localities, most of which were new to me. There was also one brief dredging trip in Ferry Reach. The best collecting for echinoderms I found at Hungry Bay, on the south shore, where 20 species were taken during my three visits. Only 8 additional species were secured at all of the other places visited. I am under great obligations to Dr. J. F. G. Wheeler for the hospitality of the Station and for his constant readiness to assist me in every way he could. Particularly I have to thank him for calling my attention to the strange occurrence of *Synaptula hydriformis* in Lovers Lake; for the opportunity to measure and examine carefully a Bermudan specimen of *Mellita quinqueisperforata*; and for his generous gift of a Bermudan Oreaster, the only one I have ever seen. Dr. H. B. Moore was also assiduous in aiding me, particularly in getting living specimens of *Leodia sexiesperforata*, and *Eucidaris tribuloides*. In the summer of 1941, Dr. Moore kindly sent me semi-fossil remains of several species of echini secured by the dredging operations in Castle Harbor. Among these were two recognizable tests of the spatangoid *Moiria atropos*, not previously known from Bermuda. To Dr. E. F. Thompson and Dr. Marie V. Lebour, I am much in-

debted for encouragement and help. I wish to acknowledge also the great kindness of Mr. L. S. Mowbray of the Bermuda Aquarium at Flatts in making a day's collecting at Gravelly Bay and in Harrington Sound possible and successful. He furthermore showed me some important specimens of Echini in the new Museum. It is a pleasure to give my hearty thanks to all of these friends who did so much to make our Bermudan visit of 1939 as profitable as pleasant.

In presenting the following revised list of the Echinoderms of Bermuda, it may be well to mention first those species previously listed whose names will not be found in the following pages, and explain the cause of their absence. There are 9 of these, as follows:

Nemaster iowensis — erroneously listed from "Bermuda" instead of "Bahamas."

Ophidiaster guildingii — erroneously listed instead of *Linckia guildingii*.

Ophiactis mülleri — listed by Verrill for *mülleri* Ltk. but there is no record of that species from Bermuda.

Ophiopsila riisci — no reliable record from Bermuda.

Ophiura brevispina — no reliable record from Bermuda.

Ophiozona imbricata — *lapsus calami* for *O. impressa*.

Ophiozona impressa — no reliable record from Bermuda.

Holothuria floridana — no reliable record from Bermuda. Heilprin's record apparently refers to *H. surinamensis*.

Leptosynapta inhaerens — mistaken identification.

The following 36 names (arranged alphabetically) occur in one or more of the earlier lists but are now considered synonyms of more correctly applied names.

<i>Actinopyga parvula</i>	= <i>Holothuria parvula</i>
<i>Amphipholis goesi</i>	= <i>Amphipholis gracillima</i>
<i>Amphipholis tenera</i>	= <i>Amphipholis squamata</i>
<i>Asterias atlantica</i>	= <i>Stolasterias tenuispina</i>
<i>Asterias tenuispina</i>	= <i>Stolasterias tenuispina</i>
<i>Asteroporpa affinis</i>	= <i>Asteroporpa annulata</i>
<i>Chondroclora vivipara</i>	= <i>Synaptula hydriformis</i>
<i>Cidaris tribuloides</i>	= <i>Eucidaris tribuloides</i>
<i>Coscinaasterias tenuispina</i>	= <i>Stolasterias tenuispina</i>
<i>Cucumaria punctata</i>	= <i>Thyone surinamensis</i>
<i>Diadema setosum</i>	= <i>Centrechinus antillarum</i>
<i>Echinoneus semilunaris</i>	= <i>Echinoneus cyclostomus</i>
<i>Hippocampe esculenta</i>	= <i>Tripneustes esculentus</i>
<i>Holothuria abbreviata</i>	= <i>Holothuria parvula</i>
<i>Holothuria captiva</i>	= <i>Holothuria parvula</i>

<i>Holothuria rathbuni</i>	= <i>Holothuria arenicola</i>
<i>Leptosynapta acanthia</i>	= <i>Eupatinapta acanthia</i>
<i>Leptosynapta roseola</i>	= <i>Epitomapta roseola</i>
<i>Mellita serforis</i>	= <i>Leodia seriesperforata</i>
<i>Mellita seriesperforata</i>	= <i>Leodia seriesperforata</i>
<i>Ophiactis krebsii</i>	= <i>Ophiactis savignyi</i>
<i>Ophiactis lymani</i>	= <i>Ophiactis algicola</i>
<i>Ophiocoma crassispina</i>	= <i>Ophiocoma echinata</i>
<i>Ophiura appressa</i>	= <i>Ophioderma appressum</i>
<i>Ophiura brevicauda</i>	= <i>Ophioderma brevicaudum</i>
<i>Ophiura cinerea</i>	= <i>Ophioderma cinereum</i>
<i>Semperia bermudensis</i>	= <i>Thyone surinamensis</i>
<i>Stichopus diaboli</i>	= <i>Stichopus badionotus</i> forma <i>diaboli</i>
<i>Stichopus moebii</i>	= <i>Stichopus badionotus</i>
<i>Stichopus xanthomela</i>	= <i>Stichopus badionotus</i> forma <i>xanthomela</i>
<i>Synapta acanthia</i>	= <i>Eupatinapta acanthia</i>
<i>Synapta inhaerens</i>	= <i>Leptosynapta inhaerens</i> (non-Bermudan)
<i>Synapta roseola</i>	= <i>Epitomapta roseola</i>
<i>Synapta viridis</i>	= <i>Synaptula hydriformis</i>
<i>Synapta vivipara</i>	= <i>Synaptula hydriformis</i>
<i>Toxopneustes variegatus</i>	= <i>Lytechinus variegatus</i>

Making due allowance then for these errors and synonyms, 48 species of Echinoderms are now known from Bermuda itself, not including Challenger Bank. This group of 48 is made up of 5 species of sea-stars, 18 brittle-stars, 12 echini and 13 holothurians. Artificial keys to aid in identifying these species will be found in the "Handbook of the Littoral Echinoderms of Porto Rico, etc." mentioned above (p. 3, lines 11-14), excepting only one or two deep water forms.

CRINOIDEA

Feather-stars

In 1907, Verrill recorded "a single specimen" of *Antedon* "too young for accurate identification" which "was obtained in 1901". This is apparently the only crinoid that has as yet been found in the Bermudas. In 1919, I recorded *Nemaster iowensis* (Springer) from Bermuda on the strength of Mr. A. H. Clark's statement that he had a specimen from there. Subsequently Mr. Clark discovered that his specimen was from the Bahamas and not from Bermuda. Obviously a crinoid fauna is practically wanting in the Bermudas.

ASTEROIDEA

Sea-stars

The scarcity of sea-stars in the marine fauna of Bermuda is one of its striking features. While 5 species are now known to occur, only one, *Stolasterias*, is at all common. Just why this should be so is not easy to understand, but it may be remarked that the entire West Indian littoral fauna contains but 17 species of sea-stars as compared with 40 in the Torres Strait region. The fauna from which Bermuda has derived her sea-stars is thus itself somewhat depauperate. It is hard to see, nevertheless, why *Astropecten* and *Echinaster* should not occur, since they are common on the shores of the southeastern United States and in the Bahama Islands. On the other hand, *Stolasterias* which occurs commonly at Bermuda, is unknown on the coast of the United States and is virtually unknown in the West Indies; a record from Cuba needs confirmation. It is common in the Mediterranean and the eastern Atlantic and it seems very probable that it reached Bermuda on foul ship bottoms.

1. *LUDIA CLATHRATA* (Say)

This sea-star lives on sandy bottoms, where it may be more or less completely buried beneath the surface. It is not strange therefore that it was not taken until 1898, when a party from New York University secured a specimen in Harrington Sound; the color of this individual was said to have been "salmon-pink" in life. The following year another party from the same University was located on Whites Island in Hamilton Harbor and secured "several specimens on the beach", but these were blue-gray above and cream-color beneath — the usual coloration of specimens from the Carolinas, Florida and the West Indies.

In 1901 Verrill reported: "Several fine specimens of this species were taken on a white shell-sand bottom in shallow water, at Trunk Island, Harrington Sound. It also occurred at Long Bird Island and other localities on shell-sand bottoms in shallow water. Its presence is indicated by a star-shaped impression in the sand. But it moves about under the sand with remarkable rapidity, when disturbed, by means of its large ambulacral tubes, so that it is not easy to capture it after it has taken alarm. Its color in life is generally light cream-color often with a rosy or flesh-colored tint and frequently with a darker grayish

or greenish median streak on each ray. It becomes at least a foot in diameter at Bermuda."

In 1906, Verrill again refers to *Luidia* as "common in some places, living under the surface of the sand. It is remarkable for the rapidity with which it can glide along, using its numerous large ambulacral feet as paddles or oars for swimming or gliding, while concealed just under the loose sand." In 1915, Verrill says of this *Luidia*: "Bermuda, common in sheltered situations just below low-tide level on bottoms of shell-sand, concealed just below the surface. All living specimens seen by me in Bermuda were either pale salmon or rose-salmon. Those from Florida and North Carolina are gray." He further repeats his earlier statements regarding the ease and rapidity of its movements and asserts further "It can also swim . . . free of the sand or on its surface" by means of "its large flattened muscular feet" which it "uses like paddles".

I have not been so fortunate as to meet with this sea-star alive in Bermuda, but have collected it on the Carolina coast and in Jamaica. The specimen taken by the New York University party in Harrington Sound, Bermuda, in 1898 is one of about 30 specimens in the M. C. Z. collection: it is a dull cream-color and has $R=140$ mm. All very young individuals in the M. C. Z. collection are very light colored, practically without pigment. As size increases, pigment usually appears in the median part of the upper surface of each ray. As a rule it spreads over the whole abactinal surface, though deepest and darkest along the radial median area. In a few individuals, the pigment is confined to that area so definitely, that the dark longitudinal line on each ray stands out conspicuously against the unpigmented background. Pink or salmon tints have not been reported from any place but Bermuda and further, more detailed observations on this point should be made. Even more important are careful observations on the movements and possible swimming powers of Bermudan *Luidias*, as reported by Verrill. No living specimen seen by me has shown any activity whatever.

2. *OREASTER RETICULATUS* var. *BERMUDENSIS*, var. nov.

Figures 1 and 2

The occurrence of *Oreaster* at the Bermudas has never been definitely recorded, but a specimen presented by Dr. J. F. G. Wheeler to the M. C. Z. in April, 1939, establishes it beyond dispute. This specimen was detected with a water glass on the bottom of Ferry Reach and was

then brought up by a diver and given to Dr. Wheeler. It is very large and obviously senescent, but it is so strikingly different from any West Indian specimen of *Oreaster* seen, that it seems proper to give it a varietal name. It is now dry and shows the effects of handling. All the rays are turned upward at the tip but there is no doubt that in life R exceeded 170 mm. and r is even now nearly 90. The rays are very wide at base, 90 mm. or more, blunt and rounded at the tip; 20 mm. orad, the ray is 35 mm. wide but not much over 20 mm. high. Vertical diameter at center of disk is about 60 mm. Abactinal skeleton most irregularly and imperfectly reticulated; there are no regular series of tubercles and the papular areas are large, irregular and ill-defined. The central portion of the disk, a space 60–70 mm. in diameter, is rather definitely delimited by narrow skeletal plates bearing conical tubercles, 2–4 mm. high and 2–3 mm. in diameter at base; on these tubercles most of the cone is bare and smooth but the basal part is finely and evenly granulated. There are about 15 supero-marginal plates on each side of each ray but at the tip they are abruptly smaller, crowded and ill-defined. Each normal plate carries a conspicuous tubercle about 8 mm. high (or long), the terminal portion (5 mm. long by 4 mm. in diameter) bare and smooth; occasionally double, the tip is more or less pointed, but the point is often irregular and may be flattened laterally to a greater or less degree. Near the end of each ray, the tubercles on all plates are much smaller and more irregularly placed.

Inferomarginal plates, entirely on the oral surface, overshadowed by the superomarginals, which they resemble more or less but they often have 2, or even 3, cones and the granulation is distinctly coarser, at least on the orad side. The rest of the oral surface is covered by convex, granulated actinal intermediate plates, each of which carries one, or very often 2 smooth cones, 2.5–5 mm. high and 2–4 mm. thick at base. Granulation of these plates is largely made up of pedicellariae and since, in this specimen, the jaws of these pedicellariae have for the most part fallen out of their sockets, the granulation appears to be made up for the most part of deeply excavated circular or elliptical cups. Adambulacral armature heavy, a single series of 5 or 6 unequal, flat, truncate furrow spines, back of which a very large irregularly conical spine (or often two of them) covers the actinal surface of the plate; these spines are commonly more or less flattened parallel with the furrow and show great diversity of size and form. Oral armature made up of similar but blunter spines; it is too deeply sunken however to permit a description of its details.

Upper surface light reddish-brown, the large tubercles and tips of the arms lighter, often nearly white. The lower surface has evidently been bleached to some extent; the many bare plates are light reddish-brown while the spines and granules are pure white, as are many large actinal plates, which have lost their epidermis.

This peculiar *Oreaster* differs from all the specimens of *reticulatus* in the M. C. Z. in the short blunt rays, the entire lack of serial arrangement of spines or papulae on the upper surface and the large conical, usually single, spines on the actinal plates. There are several West Indian specimens at hand larger than this one, and at least one is as obviously senescent, but they do not look at all like the Bermudan specimen. For the present therefore it may well bear the varietal name suggested. Obviously further material is much to be desired.

3. LINCKIA GUILDINGH Gray

(= *Ophidiaster guildingii* Verrill, 1900, p. 584, NON *Ophidiaster guildingii* Gray, 1840.)

This stiff and inert species has been taken many times in Bermuda, but it is not common anywhere. Adults are very rarely found, most of the individuals taken having the rays less than 100 mm. long. Small specimens often have 6 or rarely 7 rays but in adults 5 is the normal number. The species is tropicopolitan but the largest specimen yet recorded (M. C. Z. no. 2648) was taken July 2, 1903 at Bermuda; its longest ray is about 215 mm. The color of this sea-star shows extraordinary diversity as violet, bright blue, dull red variegated with lighter, and yellow-brown specimens are recorded. In Bermuda, however, the color seems to be always dull orange or yellow-brown. Large individuals occur lying exposed on sandy bottoms, but the great majority of specimens are found under rocks or concealed in crannies in the reef.

4. ASTERINA FOLIUM (Lütken)

Living on the under surface of rock-fragments near low water mark, this sea-star is easily overlooked. It is flat, pentagonal and rarely over 20 mm. across. Its color when adult is bluish-green or quite blue, of a light or dull shade. Young specimens may be cream-color or yellowish but they begin early to accumulate pigment dorsally. *Asterina* has been taken at Coney Island and in Castle Harbor, but apparently it is not very common.

5. *STOLASTERIAS TENUISPINA* (Lamarck)

Although an eastern Atlantic and Mediterranean species, this *Stolasterias*, easily recognizable as a rule by having 6-8 unequal arms, is the one common sea-star in Bermuda. It probably came to the islands originally on foul ship bottoms. It is now common and widely distributed and grows to a fairly large size, but specimens with R exceeding 90 mm. are seldom seen. In April, 1939, Clark G. Myers collected a very symmetrical 7-armed specimen with R=75-100 mm. and later, in Harrington Sound, he took a less symmetrical 8-armed specimen, with R ranging from 60 to 110 mm.

The largest specimen in the M. C. Z. collection (no. 1369) is an old one, labelled as from Bermuda. It is symmetrically 5 rayed and R=135 mm. The history of this specimen is of more than ordinary interest, for it was collected by A. S. Bickmore of the Museum staff, when accompanying the celebrated P. T. Barnum on an expedition to the Bermudas in 1862. Professor Louis Agassiz, in his report of February, 1863, says: "We are indebted to Mr. P. T. Barnum for the facilities he has given to Mr. Bickmore of accompanying his expedition to Bermuda, during which Mr. B. has made an extensive collection of the marine animals of that island, showing that its fauna is identical with that of the coast of Florida."

OPHIUROIDEA

Brittle-stars

Although more than a third of the species of Bermudan echinoderms are brittle-stars, only a single species, *Ophionereis reticulata*, is so widely distributed and so common that it will be found by the casual collector. It was only on the fifth day of diligent search at or near low-tide level, in April, 1939, that we found a second species, *Ophiomyxa flaccida*, and we did not see it again in the following two weeks! On the south shore, at Gravelly Bay and Hungry Bay, the 3 species of *Ophiocoma* are fairly plentiful and *Ophioderma appressum* is not hard to find in Harrington Sound. The remaining dozen species are either small, secretive forms, seldom noticed unless search is being made for them, or larger species associated with a particular habitat, such as gorgonians or sponges. The handsome colors of *Ophiomyxa flaccida* and the bright rusty-red lower surface of *Ophiocoma riisei*

make those species attractive objects, even to a person who is not a zoologist, but the other Bermudan brittle-stars are not conspicuous animals.

1. OPHIOMYXA FLACCIDA (Say)

This smooth, bright-colored, large and active brittle-star is found more or less frequently under rocks at or below low water mark near the Causeway, Long Bird Island and Coney Island. It was not found at Hungry Bay, and is not yet recorded from the southern or western shores of Bermuda. It is a typical West Indian species ranging from Bermuda to Brazil.

2. ASTEROPORPA ANNULATA Lütken

Verrill (1901) records (under the name *Astroporpa affinis* Lütken) 4 specimens of this small-bodied, long-armed ophiuran from "a large gorgonian (*Ferrucella grandis* Verrill) brought up from about 100 feet, off the outer reefs, on a fisherman's hook". It probably occurs wherever this gorgonian (now *Scirpearia grandis* (Verrill)) or similar forms are growing, and it may occasionally be washed up on a beach, but it is unlikely that it occurs normally in less than 10 fms. of water and hence it is not included among the strictly littoral echinoderms of the West Indian region.

3. AMPHIPHOLIS GRACILLIMA (Stimpson)

Verrill (1900) reports this long-armed, small-bodied amphiuroid, under the name "*Amphipholis goesi* Ljung.", as having been dredged in 20-30 ft. of water in Baileys Bay in 1898. The species is known from Charleston, S. C., through the West Indian region to Rio de Janeiro, Brazil, but I have seen no specimens from Bermuda. At Sandy Point, Buccoo Bay, Tobago, it is quite common, buried deeply in the sand, just below low-water mark.

4. AMPHIPHOLIS SQUAMATA (Delle Chiaje)

This almost cosmopolitan amphiuroid is common in Bermuda, but owing to its small size (usually less than 4 mm. across the disk) and secretive habits (hidden in shells or rock crannies) it is very easily overlooked. Verrill (1900) lists it under the name *Amphipholis tenera* (Ltk.) Ljung.

5. OPHIOSTIGMA ISACANTHUM (Say)

This small West Indian brittle-star seems to be very rare in Bermuda. Apparently neither Verrill nor the New York University parties ever met with it, nor have I. The Heilprin party (1888) took "two very young specimens, dredged in Harrington Sound". In July 1917, Dr. W. J. Crozier took 2 specimens in Fairyland Creek, a large bay in the western coast of Pembroke; these specimens are now in the M. C. Z. collection: one is a normal but rather small 5-armed adult, 3 mm. across the disk; the other is a 6-armed specimen little more than 2 mm. across the disk with 3 arms of one side smaller than the opposite 3, indicative of reproduction by schizogenesis.

6. AMPHIODIA REPENS (Lyman)

This is another small amphiuroid, which is probably fairly common, but is seldom noted, owing to its small size and secretive habits. It is rarely as much as 4 mm. across the disk, but the slender arms may be 8 times as much. The disk is light gray but the arms are white in rather marked contrast: frequently, however, there are gray markings on the arms and especially on the surface of many of the arm-spines; these dark spots on some or many arm-spines may be on either the upper or under surface or on both. This brittle-star lives more or less buried in undisturbed sand, usually where some eel-grass or similar vegetation is growing, and may be discovered by sifting such sand through a sieve. In the cove at Coney Island where *Eupatinapta acanthia* is found, *repens* is frequently met with.

7. OPHIACTIS ALGICOLA H. L. C.

This is still another secretive little brittle-star, but its habits are quite unlike the preceding. It lives among coralline algae, bryozoa, etc. on rock fragments and never buried in sand. The arms are relatively short and like the disk are variegated with light and dark shades of gray and brown. The only specimen as yet known from Bermuda was taken June 24, 1916, at "Brackish Pond Flat", by Dr. W. J. Crozier, and is now in the M. C. Z. collection.

8. OPHIACTIS SAVIGNYI (Müller and Troschel)

This very common tropicopolitan species may be found almost anywhere in the shallow waters of Bermuda living "in the interstices of

sponges and corals, often gregariously while young" (Verrill, 1900, p. 586, under the name *Ophiactis Krebsii* Lütken). Adults are rare, nearly all specimens taken having 6 arms, and the disk less than 5 mm. across.

9. OPHIOTHRIX ANGULATA (Say)

Verrill (1900, p. 585) says this species is "not common" but he gives no single record of its occurrence in the Bermudas. It does occur at Challenger Bank, but its presence in the Bermuda group itself needs confirmation.

10. OPHIOTHRIX SUENSONII Lütken

Verrill (1900, p. 585) includes this species as a Bermudan brittle-star but rests its claim on the statement that it was "collected at Bermuda by Mr. G. Brown Goode". Its occurrence at the Challenger Bank is well attested, and it is quite probable that it lives among the Gorgonians of the deeper waters of Bermuda itself.

11. OPHIONEREIS RETICULATA (Say)

This is probably the commonest Bermudan brittle-star, as it occurs wherever rock fragments rest on clean sandy bottoms. Large specimens often show a reddish tinge and in some cases the net-work of lines on the disk is quite orange-red. These brighter shades disappear, as a rule, in preserved material.

12. OPHIOCOMA ECHINATA (Lamarck)

Common under rocks near low water mark on sandy bottoms. Reaches a large size (30 mm. across disk) at Gravelly Bay and Hungry Bay on the south shore.

13. OPHIOCOMA PUMILA Lütken

Common but much more secretive than the preceding species. Adults manage to conceal themselves among algae or in crannies in rocks and corals where their dull-brown color helps to hide them. The 6-armed, green and white young are more conspicuous and much more easily found; their resemblance to *Ophiactis savignyi* is great enough to make confusion between the two species easy.

14. OPHIOCOMA RIISEI Lütken

Common at all suitable localities, such as Gravelly Bay and Hungry Bay, where it reaches maximum size (disk, 30–35 mm. in diameter, in life). The rusty-red color of the oral surface is very striking, and as it is constant, it makes a convenient “recognition mark” in the field. Unfortunately it is less obvious in preserved material.

NOTE: Verrill (1900, p. 586) reports *Ophiopsila riisei* Lütken from Bermuda, giving Lyman as his authority. There is some mistake about this, for there are no *Ophiopsilas* from Bermuda in the M. C. Z., and it is quite unlikely that Lyman ever had any specimens from there. It is possible that Lyman may have written “Bermuda” at some time when he intended to have written “Bahamas,” but this is merely a guess. Verrill’s later listing (1907, p. 284–328) is not substantiated by any definite evidence.

15. OPHIODERMA APPRESSUM (Say)

Fairly common on sandy bottom near low water mark, usually under rocks.

16. OPHIODERMA BREVICAUDUM Lütken

Reported only by Verrill (1903, p. 584) who says it was “not common” in 1898. I have never seen a Bermudan specimen. In 1907 (p. 282 (= 326)) Verrill also lists *Ophioderma brevispinum* (Say), but gives no authority for its occurrence in Bermuda. I have never seen or heard of a Bermudan specimen.

17. OPHIODERMA CINEREUM Müller and Troschel

This is one of the larger West Indian species, reaching a disk diameter of 30–35 mm. in Tobago where it is very common. Verrill says it was taken in Bermuda by the Yale party in 1898, but as he says it occurs in “interstices and crevices of the reefs,” I am dubious as to the identification of his material. In Jamaica and Tobago, it occurs only under slabs of broken coral and rock, and makes no attempt to get into interstices and crevices. Its large size and rather rigid arms are quite out of keeping with hiding in crevices!

18. OPHIOLEPIS PAUCISPINA Müller and Troschel

This little brittle-star proves to be fairly common, after one has learned where and how to find it. It lives on or in the sand under rock

fragments, and when such a fragment is turned over, it seems to be sucked up and forced to lie with its aboral surface against the lower side of the rock. As the lower surface is white or cream-color and the arms are coiled close to its margin, the brittle-star becomes rather difficult to detect. At Hungry Bay, *Ophiolepis* is quite common, but it does not seem to be so numerous along the north coast, though we took specimens at the cove on Coney Island in 1939.

ECHINOIDEA

Echini, sea-urchins, key-hole urchins, heart-urchins, etc.

Of the 12 Bermudan echini, only one, *Lytechinus variegatus atlanticus*, can be considered really common. In particular localities, *Centrechinus*, *Tripneustes* and *Echinometra*, can be secured in considerable numbers, under favorable conditions, and *Leodia sexiesperforata* is apparently fairly common on those pure sandy bottoms which it favors. The remaining half dozen species are distinctly rare or restricted to such inaccessible areas that they are rarely taken. Of two or three of these, living specimens have not yet been secured.

1. EUCIDARIS TRIBULOIDES (Lamarek).

Not very common, but occurs at North Rock, Coopers Island, and other similar reef areas.

2. CENTRECHINUS ANTILLARUM (Philippi)

Fairly common on the outer reefs and on rough, rocky shores, as at Coopers Island, Hungry Bay, etc. Listed by Verrill as "*Diadema setosum*".

3. LYTECHINUS VARIEGATUS ATLANTICUS (A. Ag.)

Very common on sandy or "grassy" bottoms. Young ones are also to be found under or among rocks. Often the rich dark red-violet color is not acquired until the urchin is half-grown, young ones being greenish, with more or less white and even with pinkish tips to the primary spines, as in Florida specimens.

4. *TRIPNEUSTES ESCULENTUS* (Leske)

Fairly common and reaching a large size, up to 150 mm. in diameter, the maximum for the species. Young ones are found under and among rocks but the adults occur out on the open bottom. Apparently there is an absence of enemies and conditions favor growth.

5. *ECHINOMETRA LUCUNTER* (Linn.)

Very common on suitable rocky areas, and conditions apparently favor growth, as in the case of *Tripneustes*, for the largest known specimens (85-90 mm. in the greater diameter) were found in Bermuda.

6. *CLYPEASTER ROSACEUS* (Linn.)

This species has not hitherto been recorded from Bermuda, but there are bare tests in the Museum at the Aquarium which I was assured were taken locally. Unfortunately there are no data with the specimens. Similar bare tests were seen at a curio store in St. George but it is possible they came from further south.

7. *CLYPEASTER SUBDEPRESSUS* (Gray)

This species, like the preceding, has hitherto been unrecorded from Bermuda, but there is at least one bare test in the Museum at the Aquarium which I was assured was taken in Bermuda. The absence of definite data is greatly to be regretted.

8. *MELLITA QUINQUIESPERFORATA* (Leske)

Verrill (1907, pp. 144 and 188) lists this species (under the name *testudinata*) as having been recorded by R. J. Nelson in 1840 as a fossil occurring on "Ireland Island and the islands in Crow Lane, Hamilton". He adds: "It has not been observed here by others, either living or fossil". It is therefore a matter of very great interest that there is a specimen at the Bermuda Biological Station which Dr. Wheeler assures me was dredged in the vicinity of St. Georges, or at least in the northeastern waters of Bermuda. This specimen is bleached to a pure white and is fragile. It is 82 mm. long by 84 mm. wide, but as the posterior margin of the test is concave, the full length may be

reckoned as 84 mm. The form is rounded pentagonal with all the angles rounded and all the sides concave, the posterior margin most markedly so. The posterior petals (I and V) are 14–15 mm. long and 6 mm. wide while the anterior (II and IV) are 13–14 mm. long and 5.5 mm. wide; unpaired petal (III) is 16×6 mm. All the petals are narrowly open. The posterior lunules (I and V) are 14 mm. long; V is about 1.5 mm. wide, but I is aberrant and somewhat deformed, 2 mm. wide at the proximal end and 5 mm. wide distally. Anterior lunules II and IV are 11 by 1 mm. and the posterior interradiar lunule is 12 by 2. Owing to the way in which the specimen is mounted for exhibition, the oral surface could not be examined.

In all of the more than 800 specimens of this *Mellita* in the M. C. Z. as well as among the scores I have examined elsewhere, I have never seen a specimen with the sides so markedly concave as in this individual from Bermuda. Another remarkable feature is seen in the small petaloid area; in a typical specimen from Florida, 80×83 mm. the petaloid area is about 50 mm. long by 45 wide, but in this Bermudan specimen, of practically the same size it is hardly more than 35 by 32. In the Florida specimen, petal III is 21 mm. long, in the Bermudan it is but 16, and the other petals are proportionate. A third notable character of the Bermudan *Mellita* is the small size of the unpaired lunule which is only 12 mm. long while the posterior paired lunules are 14. In the specimen from Florida, the posterior paired lunules are also 14 mm. but the unpaired lunule is 19 mm.

In view of these striking differences it is probable that the Bermudan *Mellita* is a local species distinct from *quinquesperforata*, or at least a well-marked variety. But until more material is available and we have some idea of the extent of individual diversity in the Bermudan form, it is hardly wise to designate it by a new name.

9. *LEODIA SEXIESPERFORATA* (Leske)

The revival of Gray's (1851) generic name for the key-hole urchins with 6 lunules, which Lambert and Thiery proposed in 1921, seems quite justified since we now know that the lunules originate in a very different manner from that found in *Mellita*. In *Leodia* they arise by resorption, in *Mellita* by the closing distally of marginal notches, a most extraordinary difference.

Leodia appears to be common at suitable places in Bermuda but exact localities have not been recorded. Dr. H. B. Moore took us, April 18, 1939, on an excursion to West Whale Bay, on the west coast

of Southampton parish, where there is a wide area of shoal water with a clean sand bottom in which *Leodia* seems to thrive. Of the specimens we secured, two were exceptionally large and one, taken by Clark G. Myers, proved to be the largest representative of the species yet recorded, as it measured 117 by 125 mm. In life *Leodia* is a pale fawn color but this becomes a deep green in killing agents of any sort, even fresh water. If, however, specimens are dried very thoroughly, directly from the sea-water, the salt can later be soaked out of them without, as a rule, affecting the color.

10. *ECHINONEUS CYCLOSTOMUS* Leske

This sluggish tropicopolitan echinoid was long since recorded from Bermuda, but very few specimens have been taken. A. H. Verrill took two from sand under rocks, at very low tide in Hungry Bay in March, 1901, but diligent search by the writer during three visits to Hungry Bay in 1939, failed to disclose a single specimen. At the Bermuda Biological Station, there is a fine bare test of large size (37×30 mm.) which was found at Coopers Island.

11. *MOIRA ATROPOS* (Lamarek)

This unmistakable spatangoid, well known from the southeastern coast of the United States and the northern West Indies, has never been taken in Bermuda, except for the two semi-fossil specimens dredged in Castle Harbor, referred to on p. 368. These are of maximum size (60 mm. long) and heavily covered with deposited lime. Whether *Moiria* is now extinct in Bermuda or still lives in suitable localities remains to be determined.

12. *BRISSUS BRISSUS* (Leske)

This spatangoid, common to the Mediterranean and the West Indies, seems to be rare at Bermuda, but there are specimens in the Museum at the Aquarium which I was assured were Bermudan. In the West Indies, *Brissus* is usually small (50–70 mm. in length) but in the eastern Atlantic and Mediterranean it is nearly twice as large (115–135 mm.). The specimens at the Aquarium were larger than any Jamaican specimens I have seen. Like *Echinoneus*, with which it is frequently associated, *Brissus* lives buried in sand under rocks, and its natural color is very similar to that of the sand.

HOLOTHURIOIDEA

Holothurians, sea-cucumbers, synaptids, etc.

Of the 13 species of holothurians, the big *Stichopus* is easily most abundant, and is moreover one of the commonest and most conspicuous of the marine invertebrates of Bermuda. Almost equally common but so much smaller and more secretive, that it is seldom noted by the average person, is *Chiridota rotifera*, found in the sand under rocks along shore wherever conditions are not unsuitable. Of 2 species (*Actinopyga agassizii*, *Holothuria impatiens*) only a single specimen of each has been taken as yet, and oddly enough both were found at the entrance to Hungry Bay. They are common West Indian forms and will probably be found ultimately in Bermuda in reasonable numbers. It is not impossible however that these two species have arrived from the south as larvae or very young individuals on ship bottoms, and are not yet fully established. Of the 5 species of *Holothuria*, 2 (*parrula* and *surinamensis*) are common and may be found on the under side of rock fragments near low watermark, wherever the water is clean and well aerated. Another species, *arenicola*, is common, at least on the south coast, deeply buried in sand under rock-fragments, but is easily overlooked. In a similar habitat occurs a fourth species (*cubana*) which seems to be rare. There are only 2 dendrochirote species; one, a *Thyone*, seems to be common in some seasons or localities and rare at others; the second, a *psolid*, has only just been discovered at Hungry Bay, where it is not very rare but is hard to detect. There are 3 species of worm-like synaptids which are more or less common, but they are so concealed by either their coloring or their habits that they are seldom noted save by the collector who knows where to locate them.

1. HOLOTHURIA CUBANA Ludwig

This small whitish holothurian lives buried in sand close to or under rock-fragments. It is very sluggish and secretive. The body wall is firm and rather rough, in part from sand grains which adhere tightly to it. We found a single specimen in April, 1939, near the "Causeway", on the Ferry Reach side.

2. HOLOTHURIA ARENICOLA Semper

This tropicopolitan species is common on the southern coast of Bermuda, particularly at Gravelly Bay and Hungry Bay. It grows to

a large size (250–300 mm. long), but always lives deeply buried in the muddy sand under rock-fragments. Owing to its dull sandy, or often rusty, color it is easily overlooked. There are always spots or blotches of dusky gray or dull purplish, but these show great diversity in number, size and distribution.

3. HOLOTHURIA IMPATIENS (Förskal)

A very fine and typical representative of this tropicopolitan species was found under a rock near low water mark at Hungry Bay, April 24, 1939. Its characteristic extrusion of copious Cuvier's organs was notable. Apparently this is the first record of *impatiens* in Bermuda.

4. HOLOTHURIA PARVULA (Selenka)

This is a very common and generally distributed small holothurian, usually under 60 mm. in length and rarely, if ever, exceeding 75 mm. The bright or deep brown color, flattened ventral surface and copious Cuvier's organs, make its recognition easy. It occurs always on the under surface of rock fragments in shallow water, and there are frequently several on a single piece of rock — sometimes there are 10–12. In all previous Bermudan lists, this species has been called *H. captiva* but *parvula* is the earlier name.

5. HOLOTHURIA SURINAMENSIS Ludwig

This is also a very common holothurian on the lower surface of rock-fragments in shallow water. It is usually about 100 mm. long but large individuals are notably extensile and may stretch to about twice that length. It is often found with *parvula*, but is readily distinguished from that species by its more cylindrical form, whitish or light yellowish tentacles and absence of Cuvier's organs. The color ranges from a reddish-brown to a dull purplish-gray, with or without more or less blotching with a different shade. Some of the large gray specimens are superficially quite like *impatiens* but are readily distinguished by the pedicels and the absence of Cuvier's organs.

6. ACTINOPYGA AGASSIZII (Selenka)

There is a single record of this species from Bermuda (W. J. Crozier, 1917, Ann. Mag. Nat. Hist. (8) 19, p. 405) but unfortunately the specimen was not preserved. It was an adult, about 250 mm. long, taken

in some 6 feet of water at the entrance to Hungry Bay. Further collecting by various individuals, at Hungry Bay and elsewhere, has failed to produce another representative of the genus. There is no apparent reason why the species should not be a permanent member of the Bermudan fauna.

7. STICHOPUS BADIONOTUS Selenka

This common West Indian holothurian is one of the most obvious and widely distributed of the Bermudan echinoderms. It seems to be present almost everywhere that the water is clear and well aerated. Unlike the *badionotus* of Jamaica, the Bermudan *Stichopus* is remarkably constant, in coloration, but in two forms. The great majority of individuals are unicolor and commonly so dark they appear to be black. Close examination in good light shows that the lower surface is lighter than the upper, and the real color is a very deep purple or blackish-brown. In some cases the color is definitely brown or even yellowish-brown, but these lighter shades are not common. The other form is a light wood-brown, orange-brown or orange-buff, more or less blotched and spotted with black or black-brown. This maculated form looks so different from its unicolored congener, that Heilprin (1888) regarded them as distinct species, each of which he thought was undescribed. The unicolored one he called *diaboli* and the spotted one, *xanthomela*. These words may be conveniently used as varietal or "form" names for Bermudan material, but in Jamaica no such distinction is possible, as spotted and unicolor forms mingle in inextricable confusion. It has been suggested that the spotted individuals in Bermuda are the young, the more heavily pigmented, unicolored ones being adults. One fact in support of this idea is that small individuals, under 100 mm. in length, and living on the lower surface of rock-fragments, have but little pigment. In life they are translucent, light buff with only the low, rounded, conspicuous papillae capped abruptly with black-brown. It is easy to assume that with increasing size and maturity, the deposits of pigment would become heavier and heavier until the animal was fully pigmented. In certain individuals however the unicolored condition is never attained — just why, it is hard to even guess, but large specimens of *xanthomela* are by no means very rare. The largest specimen of *badionotus* I have ever measured, and I believe it is the largest I have ever seen, was a true *xanthomela*, orange-buff, heavily mottled and spotted with black. It was taken April 21, 1939, while dredging in only 2 or 3 fms. of water in Ferry

Reach, and measured, in the Aquarium some hours later, more than 500 mm. long, 110–120 mm. wide and 75–80 mm. high. But complete pigmentation may be attained apparently early in life, for “black” individuals may be found less than 200 mm. long. The whole matter of pigmentation in echinoderms needs and deserves careful and exhaustive study, for it is at the present time a virtually untouched field. Research by either the physiological chemist or the biologist or both will certainly yield far-reaching and important results.

8. THYONE SURINAMENSIS Semper

This species was first recorded from Bermuda by Heilprin in 1888 as *Semperia bermudensis* sp. but ten years later, I suggested this name was a synonym of *Cucumaria punctata* Ludwig, and in 1901, I stated that the species was “not abundant” in Bermuda. In 1907, Verrill called it “the most common reef species” of holothurian. In 1926, Dr. Deichmann reported (on the strength of material from Barbados) that Ludwig’s species was identical with Semper’s *Thyone surinamensis* of 1868, and in 1930 she reported it as “abundant at Bermuda”, a statement which I modified in 1933 to “very common”. In 1939, however, I failed to find a single specimen in more than two weeks of diligent collecting. It is obvious therefore that it is not now “abundant”, except possibly in certain areas which I did not visit.

9. THYONEPSOLUS BRAZILIENSIS (Théel)

The discovery of a Psolus-like holothurian on the under side of rock-fragments at Hungry Bay, April 22, 1937, was the most interesting incident of the month’s Echinoderm-collecting. The two specimens taken measured $13 \times 6 \times 3$ mm. and $23 \times 12 \times 6$. They were not found together, but each was living closely appressed to the lower surface of a rock-fragment, sufficiently large not to be disturbed by ordinary currents or waves. The rocks were so near low-water mark, it is probable they were never quite out of water. The animals were deep rosy red (with a purplish tinge), slightly variegated with light gray, while the lower surface was light yellowish with but very little pigment. Considerable pigment has dissolved in the alcohol in which the animals are preserved but the deep rosy color is still very obvious. The resemblance in coloration to an encrusting bryozoan which occurred abundantly in small, roughly circular patches, less than 25 mm. across, on the lower surface of the rocks near low tide level, was

so exact that only touching the holothurian could assure the collector that it was not a patch of bryozoa. On Monday, April 24, further search at the same place resulted in the taking of six more specimens, which ranged in size from $10 \times 5 \times 3$ mm. to $18 \times 8 \times 4$. Preservation in alcohol results in a shrinkage of 20% or more in length and width, but alters the height very little. The coloration is alike in all the specimens, and has changed but little in alcohol; the larger specimens have the rose-color deeper and more tinged with purple than in the small specimens.

Comparison of this material with that in the M. C. Z. from Brazil and Tobago, which is labelled *Th. braziliensis*, leaves some room for doubt as to the identity of the Bermudan specimens. For the older material has lost all trace of rose-color, if it were ever present, and is simply dirty whitish. There is no hint as to what the color in life of the Brazilian form may have been, but the Tobagoan specimens, which are all much smaller than those from Bermuda, were collected by me in April, 1916, and are recorded in my note-book as "old rose" in color. Doubt as to the identity of the Bermudan form is not due so much to its notable coloration as to the fact that it has so thick a skin over the dorsal scales as to conceal them quite completely while in the Brazilian and Tobagoan specimens the scales are very distinct, with only a thin skin over them. It is quite possible, therefore, that sufficient material will demonstrate that the Bermudan *Thyonepsolus* is a distinct species. Its generic position is clearly indicated by the numerous appendages all over the dorsal surface.

10. SYNAPTULA HYDRIFORMIS (Lesueur)

The occurrence of this synaptid in Bermuda in two quite different forms has long been known. Verrill considered these forms as distinct species. The larger, more striking green and white form he called *Synapta viridis*, while the more or less striped or variegated brown form he called *Synapta vivipara*. There is no evidence that he ever critically compared the two and without such a comparison it is hard to believe they are identical. The green and white form is found among green zoanthids and algae on the margins of rock fragments or on the open sea-bottom. When among zoanthids, it may be relatively short and stout, with disproportionately long tentacles (35-50 mm. long, 5 or 6 mm. in diameter, the tentacles 10 mm. long) while among algae it is more slender and the tentacles are shorter. In both cases, the green and white (or pale gray) variegation is certainly notably concealing,

so far as human eyes are concerned. The brown and light gray or whitish (variegated or more rarely striped) form lives among brown algae and similar growths among rocks or on mangrove roots (or branches which are under water at their tips). Both forms are viviparous and agree in all structural details.

Dr. Wheeler called my attention to the fact that the dull-colored form occurred in a small land-locked body of water on St. George Island known as Lovers Lake. This seemed incredible, but he went to the lake and brought back specimens, and a visit by Dr. Moore and myself subsequently yielded many individuals, of all sizes, from the aquatic growth on the mangroves with which the lake is surrounded. While there can be no doubt that this lake has subterranean connection with the sea, the water is distinctly less saline than that of the ocean. The seawater around Bermuda has a salinity of 36.4 while that of the lake, kindly analyzed by Dr. E. F. Thompson, was only a trifle over 35. The only tangible evidence that this lessened salinity has affected the synaptids is that in the larger specimens the anchor plates in the bodywall show a tendency to deformation and many are asymmetrical. In some specimens, many, perhaps most, of the plates are abnormal but other equally mature specimens have the plates very generally normal. Apparently the difference from the individuals living in normal sea-water has not yet become a distinguishing mark of the Lovers Lake specimens. As the latter are now a practically isolated colony it will be interesting to note whether, with the passage of time, they develop any distinguishing morphological features.

Both the green and the brown Bermudan *Synaptulas* differ in general appearance in life from the Jamaican form as much as they do from each other, but I cannot find any tangible characters by which the three forms can be distinguished from each other when killed and preserved.

11. *EUPATINAPTA ACANTHIA* (H. L. Clark)

This interesting and apparently endemic species was again found in April, 1939, in the cove on Coney Island where it was originally taken but it was not secured at any other place. There seems to be little ground for doubt that the tiny synaptid, only 16 mm. long, which I identified in 1899 as *inhaerens*, was merely a very young example of *acanthia*. At that size, it is probable that two species are not certainly distinguishable.

In spite of the building of the railroad, and other local changes in

the immediate vicinity, the little cove on the northwestern side of Coney Island is very much as it was forty years ago, and it was a pleasant experience to again collect this fine synaptid at the exact spot where I dug it in 1899. Probably it will be found elsewhere, at least in Bermuda, under similar ecological conditions, but it is rather odd that no other definite locality is known. Heding (1928) records 40 specimens taken by Mortensen, July 14, 1926, but gives the locality merely as "Bermuda: sandy shore at low water". It would be interesting to know where this particular sandy shore is.

12. EPITOMAPTA ROSEOLA (Verrill)

This species was surprisingly uncommon in April, 1939, and all of the few specimens taken were very small. Hence I am unable to throw any further light on its distribution and habits, or on Heding's variety *alba*, of which Mortensen secured 27 specimens in 1926. Further study of this synaptid both at Bermuda and elsewhere is much to be desired.

13. CHIRIDOTA ROTIFERA (Pourtalès)

Apparently as common and widely distributed as it was forty years ago, this little holothurian was found plentifully at Achilles Bay, Gravelly Bay, Long Bird Island and Hungry Bay. We did not find it at the cove on Coney Island, which seems a little odd.

SUPPLEMENTARY NOTE

In addition to the above 48 species, it may be convenient to mention here the 5 additional species which are known to occur on the Challenger Bank, only about ten miles southwest of Bermuda, in water some 30 fms. deep. It is noteworthy that 4 of the 5 species are sea-stars. They are as follows:

CHAETASTER NODOSUS Perrier

Aside from its occurrence at Challenger Bank, where it seems to be fairly common, as both the "Challenger" (1873) and the "Gladisfen" (1903) secured a number of specimens, this sea-star is known only from Guadeloupe, depth unknown, 1 specimen, and from off Havana, Cuba, 140-200 fms.

OPHIDIASTER SCHISMOCHILUS H. L. C.

The holotype alone is known of this notable sea-star. It was taken by the "Gladisfen", August 1, 1903, in 30.5 fms. on Challenger Bank.

STEPHANASTERIAS GRACILIS (Perrier)

The occurrence of this West Indian sea-star on Challenger Bank in about 30 fms. is most interesting, for it is otherwise known only from numerous West Indian stations in 56-270 fms. The "Gladisfen" took 4 specimens in 1903.

CORONASTER BRIAREUS (Verrill)

The "Gladisfen" took a single specimen of this multirayed sea-star but there are no data with it. It is a deep-water species of the western Atlantic.

STYLOCIDARIS AFFINIS (Philippi)

This sea-urchin is common in the Mediterranean and in the West Indies in moderately deep water. Its occurrence at Challenger Bank, where the "Gladisfen" took one specimen, is not strange therefore, and it will not be surprising if more dredging around Bermuda itself reveals it as a resident there.